Appendix F
Sampling Analysis Plan

SAMPLING AND ANALYSIS PLAN
ORE DEBRIS AND CONCRETE MATERIALS SAMPLING, AND ALUMINUM HEEL VISUAL INSPECTION

COLUMBIA FALLS ALUMINUM COMPANY
COLUMBIA FALLS, MONTANA

Revision 2

June 2016

Prepared for:

Montana Department of Environmental Quality
Enforcement Division
P.O. Box 200901
Helena, Montana 59620

and

Calbag Resources LLC
1700 Topaz Drive
Missoula, Montana 59808

Prepared by:

Tetra Tech, Inc.
7 West 6th Avenue, Suite 612
Helena, Montana 59601
(406) 442-5588

TABLE OF CONTENTS

TABLE OF CONTENTS
(Continued)

Appendix

FIGURES

Figure

TABLES

Table

ACRONYM AND ABBREVIATION LIST

° C	Degrees Celsius
Calbag	Resources LLC
CFAC	Columbia Falls Aluminum Company
CFR	Code of Federal Regulations
DEQ	Montana Department of Environmental Quality
DU	Decision unit
EPA	U.S. Environmental Protection Agency
IDW	Investigation-derived waste
QA	Quality assurance
QAPP	Quality assurance project plan
QC	Quality control
PCB	Polychlorinated Biphenyls
RCRA	Resource Conservation and Recovery Act
RL	Reporting limit
RPD	Relative percent difference
RSL	Regional screening level
SAP	Sampling and analysis plan
SOP	Standard operating procedure
SPL	Spent pot liner
TSCA	Toxic Substances Control Act
Tetra Tech	Tetra Tech, Inc.
TCLP	Toxicity Characteristic Leaching Procedure
WMP	Waste management plan

1.0 INTRODUCTION

1.1 SITE BACKGROUND

Calbag Resources LLC (Calbag) and Tetra Tech, Inc. (Tetra Tech) prepared this sampling and analysis plan (SAP) to guide the collection and analysis of samples after the removal of spent pot liners (SPL) from the Pot Rooms Building Complex (Building 1) at the former Columbia Falls Aluminum Company (CFAC) in Columbia Falls, Montana. The location of the CFAC is shown on Figure 1.

This SAP describes the collection and analysis of bulk ore debris samples and concrete flooring, structural support, and wall material samples from Building 1, to make waste determinations. Calbag plans to sell the aluminum heels as a reusable asset. Calbag developed a quality assurance project plan (QAPP), which is included as Appendix G of the Waste Management Plan (WMP) which describes the sampling objectives and laboratory analytical protocols in greater detail.

This SAP describes the procedures for: collecting samples of bulk ore debris and concrete materials; sample preparation, handling, and laboratory analysis; field and analytical data management; quality assurance (QA) and quality control (QC) measures and protocols; investigation–derived waste (IDW) management; and other project QA/QC-related activities.

1.2 PROJECT SCOPE

After SPLs, which are a Resource Conservation and Recovery Act (RCRA) listed hazardous waste (K088), have been removed from Building 1, the residual ore debris, concrete flooring, structural support, and wall materials, must be characterized for waste determinations. To accomplish this, Calbag plans to collect and analyze samples of the basement ore debris and concrete materials from the ground and basement levels including floors, walls, and structural supports. The order of sampling and analysis will follow the order of cathode removal. After cathodes are removed from the pot rooms, beginning with pot rooms 1 and 2, concrete chip samples will be collected from the floors, walls, and structural supports as well as the battery room to determine if the concrete can be used as fill or must be disposed of off-site at a landfill. Ore debris remaining in the basements after demolition of the ground floor concrete will be consolidated into one or more piles. The piles will be sampled and a waste determination made. All ore debris will be disposed

of at the appropriate landfill. Figure 2 shows the general areas of sampling within each pot room and the battery room.

The ore debris and concrete material samples will be analyzed for RCRA 8 metals. If any of the results exceeds 20 times the RCRA toxicity characteristic action level per 40 CFR §261.24, the sample will be extracted by the Toxicity Characteristic Leaching Procedure (TCLP), the extract analyzed, and the results compared to the RCRA toxicity characteristic action level.

If any of the concrete chip s ample results exceeds the RCRA toxicity characteristic regulatory action level, then, the area the sample was collected from will be removed and disposed of at an appropriate landfill. Resampling at a higher density may be performed within the sample area that exceeded the regulatory level to better define volume for disposal at a landfill. If none of the results exceeds the RCRA toxicity characteristic regulatory action level, and with the approval of the regulatory agencies, the concrete from the ground level will be pulverized and stored outside Building 1 to be used as fill. After all ore debris is sampled and removed from the basement floors in each pot room, the floors will be brush swept, prior to sampling the basement floors and walls. If the basement concrete is deemed clean, then the floors and walls (to ground surface) may be fractured to allow for drainage and remain in place. Battery room concrete flooring material samples will be used to determine appropriate disposal of the battery room flooring material.

The samples will also be analyzed for total fluoride and total cyanide. There is no RCRA regulatory action level for fluoride. For cyanide, 40 CFR §261.23, the RCRA reactivity characteristic applies. The narrative includes using knowledge of process to demonstrate that the waste does not exhibit the characteristic of reactivity. The cyanide that has resulted from the aluminum reduction process at CFAC has not been known to react with water or generate toxic gases, vapors or fumes. Therefore, the waste is not reactive and not a D003 listed waste. Through knowledge of process, the concentrations of cyanide found in the waste debris piles are non-hazardous. Calbag will work with the appropriate landfill to determine acceptable amounts of cyanide concentrations in the ore debris for that landfill.

Further details regarding data quality objectives and laboratory analyses protocols can be found in the QAPP (Appendix G of the WMP). In addition, all concrete chips will be analyzed for polychlorinated biphenyls (PCB) using Method SW8082.

For all concrete proposed to be used as fill material, more stringent regulatory levels may be required, and will be determined by CFAC and the regulatory agencies.

This SAP describes field sampling design and protocols. The QAPP states the data quality objectives, describes the field sampling design and protocols, and provides the laboratory analysis program for the project. A health and safety plan is provided in Appendix C of the WMP.

1.3 SAMPLING AND ANALYSIS PLAN ORGANIZATION

This SAP has four sections. Section 1 is the introduction, which includes a summary of site history, project scope, and SAP organization. Section 2 describes the project approach and field procedures. Section 3 describes field documentation. Figures and tables follow Section 3. Appendix A includes applicable field standard operating procedures (SOP).

2.0 PROJECT APPROACH

2.1 SAMPLING DESIGN

Pursuant to the SAP, ore debris and concrete chip samples will be collected and sent to an off-site laboratory for chemical analysis. The applicable sampling SOP is provided in Appendix A of this SAP. The sequence of activities prior to and during sampling include the following: Calbag's environmental subcontractor, Waste Management, will remove all SPL (K088 wastes), universal waste, and locker materials. Calbag's asbestos subcontractor, IRS Environmental, will perform asbestos abatement. Calbag and its subcontractors, will follow procedures outlined in the main text of this document to ensure that during testing, management and disposal of materials, wastes are handled and disposed of properly and decontamination procedures are followed as required by 40 CFR Part 265.1101. Concrete materials from the ground and basement levels as well as ore debris piles will be sampled to make waste determinations. In the basements of each pot room, Calbag will push all of the ore debris that has collected on the floor into one or more piles and sample the debris as shown in Tables 1 and 2. All ore debris will be disposed of off-site at the appropriate landfill. All concrete that is deemed clean except for the basement floor and walls, will be pulverized and stored outside Building 1 to be used as fill. The basement floor and walls, if deemed clean, and with approval of the regulatory agencies, will be fractured to allow for drainage and remain in place after the foundation is certified as closed.

2.1.1 Ore Debris and Concrete Chip Sampling

The primary objectives of the ore debris and concrete chip sampling effort are: (1) to characterize the ore debris piles to determine proper disposal, and (2) to characterize the concrete flooring material on the ground and basement levels and the battery room of Building 1 to make waste determinations and to ensure that the concrete can be used as fill material. Figure 3 of the main text of this WMP shows the waste determination flow chart. Sample results for the battery room flooring material will be used to determine appropriate disposal options. Ore debris and concrete material sample collection will be performed in the two areas shown on Figure 2. These areas include the following:

1. Concrete materials from the floors, walls, and structural supports in each of the ten pot rooms
2. Basement ore debris piles
3. Battery storage room floor

Basement Ore Debris Piles. There is estimated to be about 220 cubic yards of ore debris in each pot room basement based on previous experience with demolition projects. The actual volume may vary. All ore debris will be disposed of off-site at the appropriate disposal facility. The piles will be formed by bulldozing and sweeping the remaining ore debris in each pot room into a pile. A five-point composite sample will then be collected from within the pile at various depths in order to adequately characterize the debris. The analytical results will be used to determine what type of landfill the debris will be placed in. The density of the samples to be collected was determined based on the expected heterogeneity of the debris and the homogeneity of activities historically completed in the different areas. The historical use of the pot lines was very uniform with the same activities throughout.

Ground Level Pot Room Concrete Materials: Each pot room is approximately 1,024 feet long and 92 feet wide (2.16 acres) as shown in Figure 2 of this document. The potential wastes are similar for each room since the process was the same throughout all ten pot rooms. Four five-point composite samples will be collected in four equal grids that are about 256 feet long and 92 feet wide (0.54 acres), from each pot room, for a total of 40 five-point composite samples from 0 to 1-inch in depth. Discrete samples may be collected from the pot room concrete floors from areas where visible staining is observed. In addition, four, five point composite samples will be

collected randomly from support structures including hammerheads, columns, and bus bar supports, and walls.

If analytical results exceed the RCRA regulatory levels per 40 CFR 261.20 (shown on Table 3), then the quadrant from about 0 to 1 inch or to a depth that shows visible staining that the sample came from will be cut up and disposed of as hazardous waste. The area may be resampled at a higher density to better identify the area within that sample grid that requires disposal of concrete to the appropriate landfill.

In addition, CFAC may use the concrete as fill material upon approval of, but not limited to, the U.S. EPA (EPA) and the DEQ Remediation Department. For all concrete deemed clean and upon approval of the regulatory agencies, the concrete will be pulverized, and stored outside Building 1 to be used as fill material.

Basement Level Pot Room Concrete Materials: Each pot room is approximately 1,024 feet long and 92 feet wide (2.16 acres) as shown on Figure 2 of this document. The potential wastes are similar for each room since the process was the same throughout all ten pot rooms. The only concrete that will be remaining at this stage of the demolition within each of the two pot rooms will be the basement floor and walls to ground surface. The basement floor will be brushed clean prior to sampling. Four five-point composite samples will be collected in four equal grids that are about 256 feet long and 92 feet wide (0.54 acres) , from each pot room, for a total of 40 five-point composite samples from 0 to 1 inch in depth. Discrete samples may be collected from the pot room concrete floors from areas where visible staining is observed.

One five-point composite sample will be collected from the wall at each end of the pot room for a total of 20 samples.

If analytical results exceed the regulatory levels shown in Table 2 of the QAPP (Appendix G of the WMP), then the quadrant from about 0 to 1 inch or to the depth of visible staining that the sample came from will be cut up and disposed of accordingly. The sample grid may be resampled at a higher density to identify the volume of concrete requiring disposal to the appropriate landfill.

For all concrete deemed clean, the concrete will remain in place. Calbag's professional engineer and the DEQ will inspect the intact foundation to certify closure in accordance with 40 CFR §264.115. Upon approval of the regulatory agencies, the concrete may be fractured to allow for drainage.

Battery Storage Room Concrete Floor: The battery storage room concrete floor is 2,400 square feet in size (Figure 2). Used batteries were stored in this room for years. Visible staining is present on the floor. Three five-point composite samples will be collected. In addition, discrete samples will be collected where visible staining is most prevalent. If necessary, if concrete samples exceed the toxicity characteristic action level shown on Table 3, then the concrete will be cut up and disposed of at the appropriate landfill.

2.1.2 Aluminum Heel Vacuuming and Visual Inspection

The aluminum heels will be removed from the cathodes. They will then be vacuumed and visibly inspected for carbon, which is a black slag like material with a vitreous luster. The heels are silvery white with a metallic luster. If any carbon material is observed on the heel after vacuuming, then the heel will be re-vacuumed and hand brushed until visibly free of all carbon. If carbon material is still visibly present, then that area will be hand-brushed and re-vacuumed to ensure it is free of carbon and visibly observed again. This process will be repeated until all visible carbon is removed. The heel will then be moved to a storage area prior to trucking to a facility where it will be melted down for reuse. There are 372 heels in Building 1.

2.2 FIELD METHODS

This section describes field equipment and supplies (Section 2.2.1), bulk sampling methods for disposal characterization (Section 2.2.2), concrete chip sampling methods (Section 2.2.3), visual heel inspection (Section 2.2.4), decontamination procedures (Section 2.2.5), field quality control (QC) samples (Section 2.2.6), sample labeling (Section 2.2.7), sample handling (Section 2.2.8), and sample documentation, packaging, and transport (Section 2.2.9). Appendix A includes SOPs to guide the field sampling efforts.

2.2.1 Field Equipment and Supplies

A list of necessary field equipment and supplies is provided in Table 1. The Sample Team Leader or a designee will inspect all equipment prior to use. Unacceptable supplies will be returned to the supplier.

2.2.2 Ore Debris Sampling

Composite samples will be collected from ten ore debris piles as shown in Figure 2. It is anticipated that the piles will be about 220 cubic yards each. Table 2 shows sample matrices and numbers. The ore debris will be disposed of at the appropriate disposal facility.

Each composite sample will consist of five aliquots collected from the debris pile. The five aliquots will be collected at different depths to ensure adequate representation of both the entire pile. The aliquots will be composited in a stainless steel bowl using a stainless steel trowel or shovel. The composited sample will be transferred to an 8-ounce wide-mouth jar, labeled, documented, and shipped for laboratory analysis. Table 2 is the sample number and analysis summary table. Table 3 shows analytical methods, sample containers, preservation requirements, and holding times. SOPs for sample collection are in Appendix A.

2.2.3 Concrete Material Sampling

The pot room concrete materials and battery room floors will be characterized by collecting composite concrete chip samples. The sampling will generally adhere to the Bulk Concrete Chip Sampling SOP provided in Appendix A of this document. A systematic random design will be used to collect sample aliquots.

Using a pneumatic chip hammer or similar device, a 3-inch by 3-inch sample area of the concrete surface will be broken up to a depth of 0 to 1 inch. The concrete particles will be collected using a new 1-inch to 2-inch wide brush (one dedicated brush per sampling quadrant). Approximately 8 ounces of concrete chips will be collected from the center of the 3-inch by 3-inch sample area to insure uniform subsample distribution within and between sample areas. The concrete chips will be placed in a labeled 8-ounce wide-mouth glass sample jar and placed in a cooler on ice. The samples will be shipped to the laboratory at the end of the day.

The types and number of samples to be collected are provided in Table 2. Table 3 shows the analytical methods, sample containers, sample preservation, and holding time requirements.

2.2.4 Aluminum Heel Visual Inspection

Each pot will be brought into the SPL containment area located in the Crane Transfer Bay at the end of each pot room. The heels will be removed from the cathodes and placed to the side in the SPL containment area. A visual inspection will be performed by viewing all sides of each aluminum heel looking for carbon material, which is black, slag-like material indicative of K088 material. The visible inspection and heel cleaning procedures will be performed as described above in Section 2.1.2.

2.2.5 Decontamination

Decontamination is required for all non-disposable sampling equipment. Decontamination procedures for specific sampling equipment are described in the following sections and in the decontamination SOP provided in Appendix A (SOP 002).

Non-Disposable Sampling Equipment: All non-disposable, non-dedicated sampling equipment will be decontaminated between uses. This includes shovels, hand trowels, and stainless steel bowls for sample compositing. Table 1 shows field equipment that will be needed for the sample collection.

In general, the procedure to be used for decontamination of non-disposable, non-dedicated sampling equipment is:

- Spray with Liquinox or an Alconox-distilled water solution
- Triple rinse with distilled water
- Dry with a clean paper towel
- Store in a clean plastic bag until needed
- Store equipment such as shovels in plastic bags

2.2.6 Field Quality Control Samples

Field QC samples are used to assess sample collection techniques, environmental conditions during sample collection and transport, and laboratory QC. Field QC samples for this project will include equipment rinsate blanks and temperature blanks.

2.2.6.1 Equipment Rinsate Blanks

Equipment rinsate blanks will be collected to evaluate the effectiveness of the equipment decontamination procedures. Equipment rinsate blanks are clean, deionized, metals-free water samples that are exposed to decontaminated sampling equipment in a manner consistent with how investigative sample media contact the equipment. Equipment rinsate blanks will be analyzed for the same analytes as the field samples. Equipment rinsate blanks will be collected at a frequency of one per day of sampling, immediately following equipment decontamination, and will include at least one ore debris equipment rinsate blank.

2.2.6.2 Temperature Blanks

A temperature blank is used to monitor the temperature of the samples during transport to the laboratory. The temperature blank consists of distilled water in a glass or plastic sample container. A temperature blank must be included in each cooler of samples submitted for analysis. When the cooler is received at the laboratory, the laboratory sample custodian will measure and record the temperature of the temperature blank. It should be within the project criterion of 4±2°C and should be recorded on the sample receipt form, which should be included in the laboratory data package.

2.2.7 Sample Labeling

A sample numbering scheme has been developed that allows each sample to be uniquely identified, and provides a means of tracking the sample from collection through analysis. The sampling number will indicate the sampling area, grid number, and sample type. It will be entered on sample labels, field sampling forms, chain-of-custody forms, and other sample records.

The field sample labeling system will be as follows:

DU1-C-20160101

where:

DU1	=	Decision Unit (DU1, DU2, DU3…)
C	=	Sample matrix (C = concrete, OD = ore debris
20160101	=	Sample date

Sample labels will be completed using indelible ink and attached to the sample containers when each sample is collected. The following information will be included on the sample label:

- Company name
- Sample identification number
- Date and time of sample collection
- Preservation
- Analyses to be performed
- Sample matrix
- Sampler's initials

2.2.8 Sample Handling

The preservation and holding time requirements for the samples are shown in Table 3.

2.2.9 Sample Documentation, Packaging, and Transport

The samples will be securely packaged and shipped to the laboratory. All samples will be packaged and labeled for shipping in compliance with current regulations. Only metal or plastic ice chests will be used for storing and transporting samples. The samples will be placed in a cooler and padded with bubble wrap to absorb shock. The chain-of-custody form will be completed by sampling personnel and by the laboratory when the sample cooler is received.

2.3 PROJECT SCHEDULE

The project schedule will be occur as described in the WMP and QAPP (Appendix G of the WMP).

3.0 FIELD DOCUMENTATION

3.1 FIELD LOGBOOK

Field activities will be documented in a bound field logbook that is dedicated to the project site. The logbook will be water-resistant, and all entries will be made in indelible ink. The logbook will be used to record all pertinent information about sampling activities, site conditions, field methods, general observations, and other pertinent technical information. The SOP for recording data in the logbook is provided in Appendix A. Photographs of the sampling grids will be taken and will be documented in the logbook. Examples of typical logbook entries include:

- Date and time
- Personnel present

- Daily temperature and other climatic conditions
- Field measurements, activities, and observations
- Referenced sampling location description (in relation to a stationary landmark) and map
- Media sampled
- Sample collection methods and equipment
- Date and time of sample collection
- Types of sample containers used
- Sample identification and cross-referencing
- Sample types and preservatives used
- Analytical parameters
- Sampling personnel, distribution, and transporters
- Site sketches and global positioning system coordinate names
- Photograph descriptions and number
- Instrument calibration procedures and frequency
- Visitors to the site
- Deviations from the SAP

The Field Team Leader or designee will be responsible for daily maintenance of all field records. Each page of the logbook will be numbered, dated, and signed by the person making the entry. Corrections to the logbook will be made by using a single strike mark through the entry to be corrected, then recording and initialing the correct entry. The date of the correction will be noted for corrections made later.

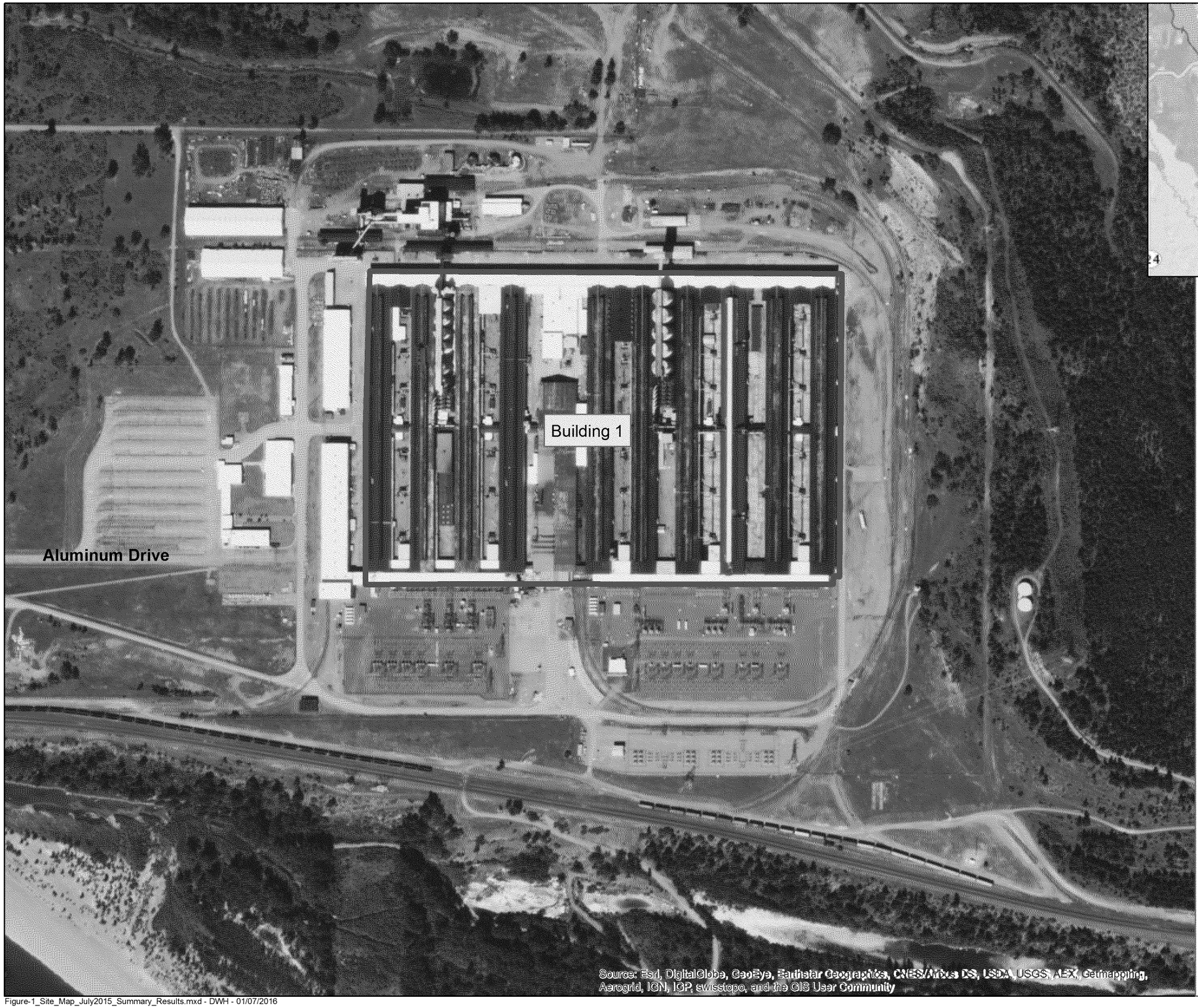
Photographs taken in the field will be numbered and recorded in the logbook. The name of the photographer, date, time, site location, direction of photograph, and photograph description will be entered sequentially in the logbook as photographs are taken.

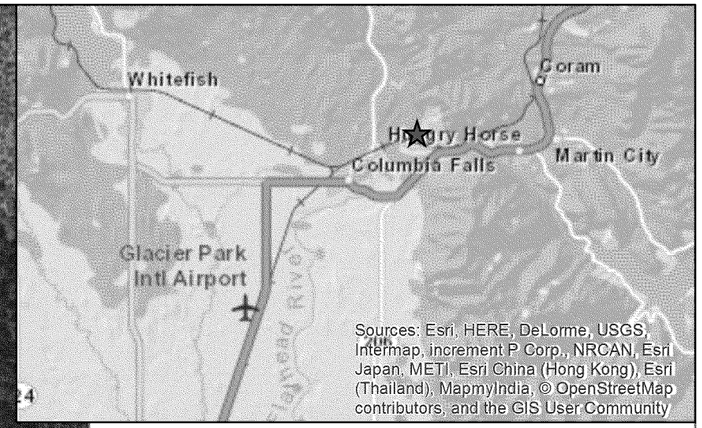
Any problems encountered and actions taken or deviations from the Field Sampling Plan will be noted in the logbook. The SAP procedure will be referenced and the specific deviation noted.

3.2 CHAIN-OF-CUSTODY PROCEDURES

A chain-of-custody form is used to establish and maintain sample custody documentation that reflects sample possession from time of collection through sample analysis and disposition. The sampler will complete and sign a chain-of-custody form which will accompany the samples to the laboratory. The chain-of-custody form will indicate the date, time, sample location, number of containers, analytical parameters, and designated sample numbers for each sample location. The original signed copy of the chain-of-custody form will be left with the laboratory and copies will be retained by Calbag.

FIGURES





Locator Map

LEGEND

★ Columbia Falls Aluminum Company

Pot Room Building Complex/Building 1

N

0 400 800

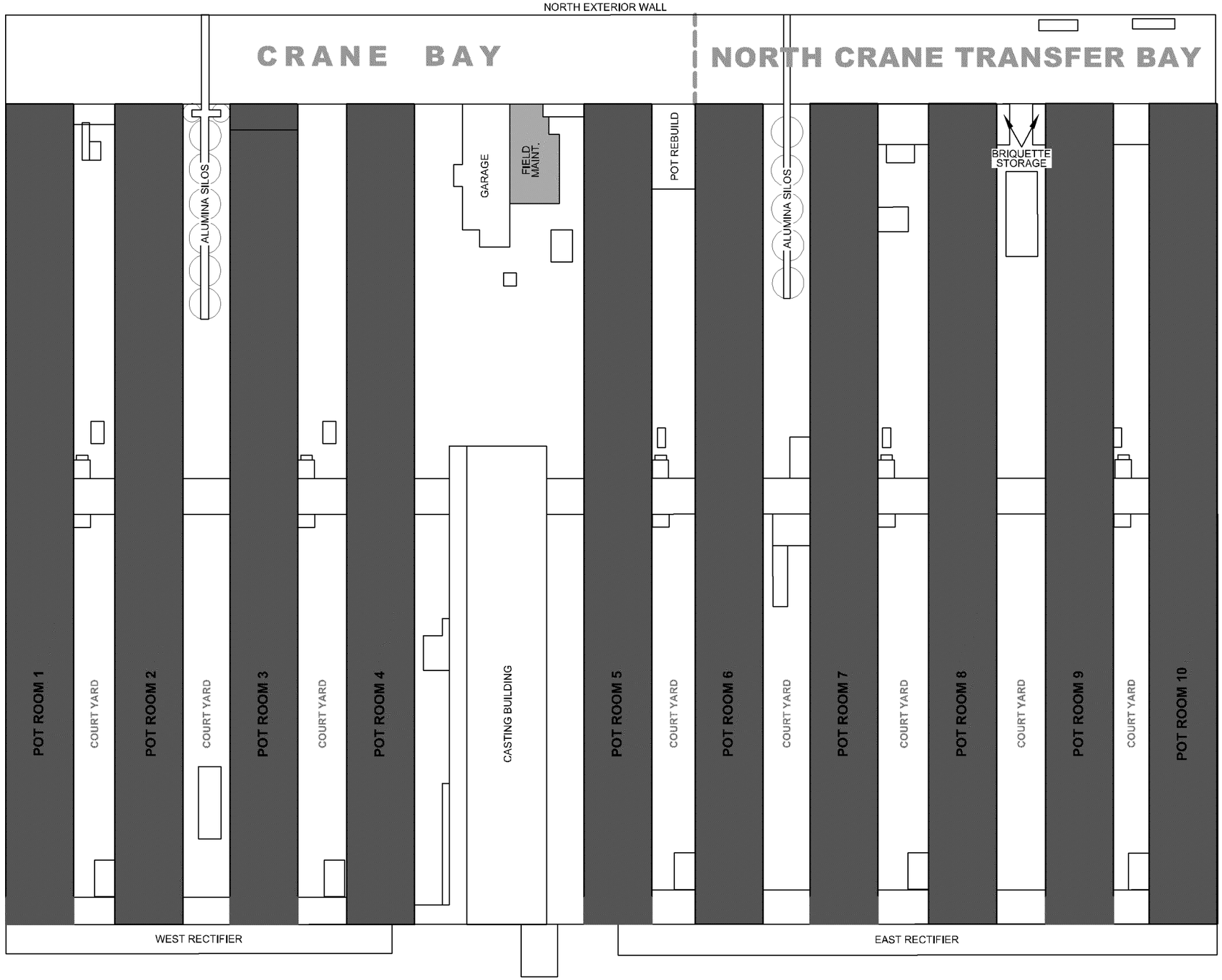
Feet

CFAC-Columbia Falls Aluminum Company
Columbia Falls, Montana

FIGURE 1
POT ROOM BUILDING COMPLEX
SITE MAP

Figure-1_Site_Map_July2015_Summary_Results.mxd - DWH - 01/07/2016

2018-003543-0223



LEGEND

SAMPLE AREA 1:
ORE DUST DEBRIS PILE (LOCATION SUBJECT TO CHANGE)
(AREA = 55,200 sq ft TOTAL. 5,520 sq ft FOR EACH PILE)

SAMPLE AREA 2:
BATTERY STORAGE ROOM
CONCRETE AND RESIDUAL DEBRIS
(AREA = 2,400 sq ft)

SAMPLE AREA 3:
POT LINE CONCRETE
(AREA = 950,000 sq ft TOTAL. 95,000 sq ft FOR EACH ROOM)

N

SCALE: NO SCALE

CFAC-Columbia Falls Aluminum Company
Columbia Falls, Montana

FIGURE 2
PROPOSED CONCRETE AND ORE DEBRIS SAMPLING AREAS

SOURCE: MODIFIED FROM CFAC-COLUMBIA FALLS ALUMINUM COMPANY

Figure 2_Proposed Sampling Areas_rev1.dwg - DWH - 03/04/2016

TABLES

TABLE 1
FIELD EQUIPMENT

Equipment	Inspection/ Maintenance	Calibration	Spare Parts	Owner's Manual
Pneumatic hammer or other chipping device	Daily, Decontaminated between locations	Not applicable	As needed	Product manual
Stainless steel bowls for compositing samples	Decontaminated between locations	Not applicable	Not applicable	Not applicable
Hot Saw or Chain Saw	Daily, Decontaminated between locations	Not applicable	Not applicable	Product manual
Disposable and Other Supplies				
Nitrile gloves	Gallon zip-type bags	Leather gloves	Materials will be ordered from vendors or bought at hardware stores.	
Paper towels	Wet wipes	Trash bags		
100-foot tape measure	Spray bottles	Trowels		
Shovels	Spud bar	--		

TABLE 2
DECISION UNITS, SAMPLING DEPTHS, AND NUMBER OF SAMPLES

Decision Unit	Sample Depth (inches below floor surface)	Number and Type of Samples
Unstained areas of concrete floor in pot rooms ground level and basement level	0 – 1	80 Composite (5-point each, 40 samples per floor)
Ground level concrete support structures and walls	0 – 1	4 Composite (5-point each)
Basement walls	0 - 1	20 Composite; 1 from each end of the 10 pot rooms (5-point each)
Stained areas of concrete floor in all pot rooms	0 – 1	Number TBD: discrete samples will be collected from where visible staining is observed
Battery room	0 – 1	3 Composite (5-point each)
Ore debris	Total depth of each pile, TBD	10 Composite (5-point each; 1 sample from each of the ten pot room piles)

Notes: TBD To be determined

TABLE 3
ANALYTICAL METHODS, SAMPLE CONTAINERS, AND PRESERVATION REQUIREMENTS AND REGULATORY LEVELS

Sample Matrix	Analysis/Analytical Method	Regulatory Level	Sample Container	Preservation/Holding Time
Concrete material	RCRA 8 metals by EPA SW6020/SW7471	20 times the RCRA Toxicity Characteristic action levels in 40 CFR 261.24	One 8-ounce wide mouth jar	Cool to 4±2° C/28 days for mercury; 180 days for others
	Total cyanide by EPA SW9012	40 CFR 261.23	One 8-ounce wide mouth jar	Cool to 4±2° C/14 days
	Fluoride by EPA 300.0	NA	One 8-ounce wide mouth jar	None/28 days
	PCBs by EPA SW8082	NA	One-250-mL wide mouth jar with a PTFE-lined lid	Cool to 4±2° C/14 days to extraction and 40 days to analysis
Ore debris	RCRA 8 metals by EPA SW6020/SW7471	20 times RCRA Toxicity Characteristic action levels in 40 CFR 261.24	One 8-ounce wide mouth jar	Cool to 4±2° C/28 days mercury; 180 days for others
	Fluoride by EPA 300.0	NA	One 8-ounce wide mouth jar	None/28 days
	Total cyanide by EPA SW9012	40 CFR 261.23	One 8-ounce wide mouth jar	Cool to 4±2° C/14 days

Notes:
CFR Code of Federal Regulations
EPA U.S. Environmental Protection Agency
NA Not applicable
PCB Polychlorinated biphenyl
PTFE Polytetrafluoroethylene
RCRA Resource Conservation and Recovery Act

APPENDIX A

TETRA TECH, INC.
STANDARD OPERATING PROCEDURES

CHIP, WIPE, AND SWEEP SAMPLING

SOP#: 2011
DATE: 11/16/94
REV. #: 0.0

1.0 SCOPE AND APPLICATION

This standard operating procedure (SOP) outlines the recommended protocol and equipment for collection of representative chip, wipe, and sweep samples to monitor potential surficial contamination.

This method of sampling is appropriate for surfaces contaminated with non-volatile species of analytes (i.e., PCB, PCDD, PCDF, metals, cyanide, etc.) Detection limits are analyte specific. Sample size should be determined based upon the detection limit desired and the amount of sample requested by the analytical laboratory. Typical sample area is one square foot. However, based upon sampling location, the sample size may need modification due to area configuration.

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent on site conditions, equipment limitations or limitations imposed by the procedure or other procedure limitations. In all instances, the ultimate procedures employed should be documented and associated with the final report.

Mention of trade names or commercial products does not constitute U.S. EPA endorsement or recommendation for use.

2.0 METHOD SUMMARY

Since surface situations vary widely, no universal sampling method can be recommended. Rather, the method and implements used must be tailored to suit a specific sampling site. The sampling location should be selected based upon the potential for contamination as a result of manufacturing processes or personnel practices.

Chip sampling is appropriate for porous surfaces and is generally accomplished with either a hammer and chisel, or an electric hammer. The sampling device should be laboratory cleaned and wrapped in clean, autoclaved aluminum foil until ready for use. To collect the sample, a measured and marked off area is chipped both horizontally and vertically to an even depth of 1/8 inch. The sample is then transferred to the proper sample container.

Wipe samples are collected from smooth surfaces to indicate surficial contamination; a sample location is measured and marked off. While wearing a new pair of surgical gloves, a sterile gauze pad is opened, and soaked with solvent. The solvent used is dependent on the surface being sampled. This pad is then stroked firmly over the sample surface, first vertically, then horizontally, to ensure complete coverage. The pad is then transferred to the sample container.

Sweep sampling is an effective method for the collection of dust or residue on porous or non-porous surfaces. To collect such a sample, an appropriate area is measured off. Then, while wearing a new pair of disposable surgical gloves, a dedicated brush is used to sweep material into a dedicated dust pan. The sample is then transferred to the proper sample container.

Samples collected by all three methods are then sent to the laboratory for analysis.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

Samples should be stored out of direct sunlight to reduce photodegredation, cooled to 4°C and shipped to the laboratory performing the analysis. Appropriately sized laboratory cleaned, glass sample jars should be used for sample collection. The amount of sample required will be determined in concert with the analytical laboratory.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

This method has few significant interferences or problems. Typical problems result from rough porous

surfaces which may be difficult to wipe, chip, or sweep.

5.0 EQUIPMENT

Equipment required for performing chip, wipe, or sweep sampling is as follows:

- Lab clean sample containers of proper size and composition
- Site logbook
- Sample analysis request forms
- Chain of Custody records
- Custody seals
- Field data sheets
- Sample labels
- Disposable surgical gloves
- Sterile wrapped gauze pad (3 in. x 3 in.)
- Appropriate pesticide (HPLC) grade solvent
- Medium sized laboratory cleaned paint brush
- Medium sized laboratory cleaned chisel
- Autoclaved aluminum foil
- Camera
- Hexane (pesticide/HPLC grade)
- Iso-octane
- Distilled/deionized water

6.0 REAGENTS

Reagents are not required for preservation of chip, wipe or sweep samples. However, reagents will be utilized for decontamination of sampling equipment.

7.0 PROCEDURES

7.1 Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, and the types and amounts of equipment and supplies needed.

2. Obtain necessary sampling and monitoring equipment.

3. Decontaminate or preclean equipment, and ensure that it is in working order.

4. Prepare scheduling and coordinate with staff, clients, and regulatory agency, if appropriate.

5. Perform a general site survey prior to site entry in accordance with the site specific Health and Safety Plan.

6. Mark all sampling locations. If required the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions.

7.2 Chip Sample Collection

Sampling of porous surfaces is generally accomplished by using a chisel and hammer or electric hammer. The sampling device should be laboratory cleaned or field decontaminated as per the Sampling Equipment Decontamination SOP. It is then wrapped in cleaned, autoclaved aluminum foil. The sampler should remain in this wrapping until it is needed. Each sampling device should be used for only one sample.

1. Choose appropriate sampling points; measure off the designated area. Photo documentation is optional.

2. Record surface area to be chipped.

3. Don a new pair of disposable surgical gloves.

4. Open a laboratory-cleaned chisel or equivalent sampling device.

5. Chip the sample area horizontally, then vertically to an even depth of approximately 1/8 inch.

6. Place the sample in an appropriately prepared sample container with a Teflon lined cap.

7. Cap the sample container, attach the label and custody seal, and place in a plastic bag. Record all pertinent data in the site logbook and on field data sheets. Complete the sampling analysis request form and chain of custody record before taking the next sample.

8. Store samples out of direct sunlight and cool to 4EC.

9. Follow proper decontamination procedures then deliver sample(s) to the laboratory for analysis.

7.3 Wipe Sample Collection

Wipe sampling is accomplished by using a sterile

gauze pad, adding a solvent in which the contaminant is most soluble, then wiping a pre-determined, pre-measured area. The sample is packaged in an amber jar to prevent photodegradation and packed in coolers for shipment to the lab. Each gauze pad is used for only one wipe sample.

1. Choose appropriate sampling points; measure off the designated area. Photo documentation is optional.

2. Record surface area to be wiped.

3. Don a new pair of disposable surgical gloves.

4. Open new sterile package of gauze pad.

5. Soak the pad with solvent of choice.

6. Wipe the marked surface area using firm strokes. Wipe vertically, then horizontally to insure complete surface coverage.

7. Place the gauze pad in an appropriately prepared sample container with a Teflon-lined cap.

8. Cap the sample container, attach the label and custody seal, and place in a plastic bag. Record all pertinent data in the site logbook and on field data sheets. Complete the sampling analysis request form and chain of custody record before taking the next sample.

9. Store samples out of direct sunlight and cool to 4°C.

10. Follow proper decontamination procedures, then deliver sample(s) to the laboratory for analysis.

7.4 Sweep Sample Collection

Sweep sampling is appropriate for bulk contamination. This procedure utilizes a dedicated, hand held sweeper brush to acquire a sample from a pre-measured area.

1. Choose appropriate sampling points; measure off the designated area. Photo documentation is optional.

2. Record the surface area to be swept.

3. Don new pair of disposable surgical gloves.

4. Sweep the measured area using a dedicated brush; collect the sample in a dedicated dust pan.

5. Transfer sample from dust pan to sample container.

6. Cap the sample container, attach the label and custody seal, and place in a plastic bag. Record all pertinent data in the site log book and on field data sheets. Complete the sampling analysis request form and chain of custody record before taking the next sample.

7. Store samples out of direct sunlight and cool to 4EC.

8. Leave contaminated sampling device in the sample material, unless decontamination is practical.

9. Follow proper decontamination procedures, then deliver sample(s) to the laboratory for analysis.

8.0 CALCULATIONS

Results are usually provided in mg/g, µg/g, mass per unit area, or other appropriate measurement. Calculations are typically done by the laboratory.

9.0 QUALITY ASSURANCE/ QUALITY CONTROL

The following general quality assurance procedures apply:

1. All data must be documented on standard chain of custody forms, field data sheets or within the site logbook.

2. All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation, and they must be documented.

The following specific quality assurance activities apply to wipe samples:

For wipe samples, a blank should be collected for each sampling event. This consists of a sterile gauze pad, wet with the appropriate solvent, and placed in a prepared sample container. The blank will help identify potential introduction of contaminants via the sampling methods, the pad, solvent or sample container. Spiked wipe samples can also be collected to better assess the data being generated. These are prepared by spiking a piece of foil of known area with a standard of the analyte of choice. The solvent containing the standard is allowed to evaporate, and the foil is wiped in a manner identical to the other wipe samples.

Specific quality assurance activities for chip and sweep samples should be determined on a site specific basis.

10.0 DATA VALIDATION

A review of the quality control samples will be conducted and the data utilized to qualify the environmental results.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow EPA, OSHA and corporate health and safety procedures.

12.0 REFERENCES

U.S. EPA, A Compendium of Superfund Field Operation Methods. EPA/540/5-87/001.

NJDEP Field Sampling Procedures Manual, February, 1988.

SOP APPROVAL FORM

TETRA TECH EM INC.

ENVIRONMENTAL STANDARD OPERATING PROCEDURE

GENERAL EQUIPMENT DECONTAMINATION

SOP NO. 002

REVISION NO. 3

Last Reviewed: June 2009

Quality Assurance Approved	Date
	6-19-09

1.0 BACKGROUND

All nondisposable field equipment must be decontaminated before and after each use at each sampling location to obtain representative samples and to reduce the possibility of cross-contamination.

1.1 PURPOSE

This standard operating procedure (SOP) establishes the requirements and procedures for decontaminating equipment in the field.

1.2 SCOPE

This SOP applies to decontaminating general nondisposable field equipment. To prevent contamination of samples, all sampling equipment must be thoroughly cleaned prior to each use.

1.3 DEFINITIONS

Alconox: Nonphosphate soap, obtained in powder detergent form and dissolved in water

Liquinox: Nonphosphate soap, obtained in liquid form for mixing with water

1.4 REFERENCES

U.S. Environmental Protection Agency (EPA). 1992a. "Guide to Management of Investigation-Derived Wastes." Office of Solid Waste and Emergency Response. Washington D.C. EPA 9345.3-03FS. January.

EPA. 1992b. "RCRA Ground-Water Monitoring: Draft Technical Guidance." Office of Solid Waste. Washington, DC. EPA/530-R-93-001. November.

EPA. 1994. "Sampling Equipment Decontamination." Environmental Response Team SOP #2006 (Rev. #0.0, 08/11/94). http://www.ert.org/mainContent.asp?section=Products&subsection=List

1.5 REQUIREMENTS AND RESOURCES

The equipment required to conduct decontamination is as follows:

- Scrub brushes
- Large wash tubs or buckets
- Squirt bottles
- Alconox or Liquinox
- Tap water
- Distilled water
- Plastic sheeting
- Aluminum foil
- Methanol or hexane
- Isopropanol (pesticide grade)
- Dilute (0.1 N) nitric acid

2.0 PROCEDURE

The procedures below discuss decontamination of personal protective equipment (PPE), drilling and monitoring well installation equipment, borehole soil sampling equipment, water level measurement equipment, general sampling equipment, and groundwater sampling equipment.

2.1 PERSONAL PROTECTIVE EQUIPMENT DECONTAMINATION

Personnel working in the field are required to follow specific procedures for decontamination prior to leaving the work area so that contamination is not spread off site or to clean areas. All used disposable protective clothing, such as Tyvek coveralls, gloves, and booties, will be containerized for later disposal. Decontamination water will be containerized in 55-gallon drums (refer to Section 3.0).

Personnel decontamination procedures will be as follows:

1. Select an area removed from sampling locations that is both downwind and downgradient. Decontamination must not cause cross-contamination between sampling points.

2. Maintain the same level of personal protection as was used for sampling.

3. Wash neoprene boots (or neoprene boots with disposable booties) with Liquinox or Alconox solution and rinse with clean water. Remove booties and retain boots for subsequent reuse.

4. Wash outer gloves in Liquinox or Alconox solution and rinse in clean water. Remove outer gloves and place into plastic bag for disposal.

5. Remove Tyvek or coveralls. Containerize Tyvek for disposal and place coveralls in plastic bag for reuse.

6. Remove air purifying respirator (APR), if used, and place the spent filters into a plastic bag for disposal. Filters should be changed daily or sooner depending on use and application. Place respirator into a separate plastic bag after cleaning and disinfecting.

7. Remove disposable gloves and place them in plastic bag for disposal.

8. Thoroughly wash hands and face in clean water and soap.

2.2 DRILLING AND MONITORING WELL INSTALLATION EQUIPMENT DECONTAMINATION

All drilling equipment should be decontaminated at a designated location on site before drilling operations begin, between borings, and at completion of the project. Decontamination may be conducted on a temporary decontamination pad constructed at satellite locations within the site area in support of temporary work areas. The purpose of the decontamination pad is to contain wash waters and potentially contaminated soil generated during decontamination procedures. Decontamination pads may be constructed of concrete, wood, or plastic sheeting, depending on the site-specific needs and plans. Wash waters and contaminated soil generated during decontamination activities should be considered contaminated and thus, should be collected and containerized for proper disposal.

Monitoring well casing, screens, and fittings are assumed to be delivered to the site in a clean condition. However, they should be steam cleaned and placed on polyethylene sheeting on-site prior to placement downhole. The drilling subcontractor will typically furnish the steam cleaner and water.

The drilling auger, bits, drill pipe, any portion of drill rig that is over the borehole, temporary casing, surface casing, and other equipment used in or near the borehole should be decontaminated by the drilling subcontractor as follows:

1. Select an area removed from sampling locations that is both downwind and downgradient. Decontamination must not cause cross-contamination between sampling points.
2. Maintain the same level of personal protection as was used for sampling.
3. Remove loose soil using shovels, scrapers, wire brush, etc.
4. Steam clean or pressure wash to remove all visible dirt.
5. If equipment has directly or indirectly contacted contaminated media and is known or suspected of being contaminated with oil, grease, polynuclear aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCB), or other hard to remove organic materials, rinse equipment with pesticide-grade isopropanol.
6. To the extent possible, allow components to air dry.
7. Wrap or cover equipment in clear plastic until it is time to be used.
8. All wastewater from decontamination procedures should be containerized.

2.3 BOREHOLE SOIL SAMPLING DOWNHOLE EQUIPMENT DECONTAMINATION

All soil sampling downhole equipment should be decontaminated before use and after each sample as follows:

1. Select an area removed from sampling locations that is both downwind and downgradient. Decontamination must not cause cross-contamination between sampling points.
2. Maintain the same level of personal protection as was used for sampling.
3. Prior to sampling, scrub the split-barrel sampler and sampling tools in a wash bucket or tub using a stiff, long bristle brush and Liquinox or Alconox solution.
4. After sampling, steam clean the sampling equipment over the rinsate tub and allow to air dry.
5. Place cleaned equipment in a clean area on plastic sheeting and wrap with aluminum foil.
6. Containerize all water and rinsate; disposable single-use sampling equipment should also be containerized.
7. Decontaminate all equipment placed down the hole as described for drilling equipment.

2.4 WATER LEVEL MEASUREMENT EQUIPMENT DECONTAMINATION

Field personnel should decontaminate the well sounder and interface probe before inserting and after removing them from each well. The following decontamination procedures should be used:

1. Select an area removed from sampling locations that is both downwind and downgradient. Decontamination must not cause cross-contamination between sampling points.
2. Maintain the same level of personal protection as was used for sampling.
3. Wipe the tape and probe with a disposable Alconox- or Liquinox-impregnated cloth or paper towel.
4. If immiscible layers are encountered, the interface probe may require steam cleaning or washing with pesticide-grade isopropanol.
5. Rinse with deionized water.

2.5 GENERAL SAMPLING EQUIPMENT DECONTAMINATION

All nondisposable sampling equipment should be decontaminated using the following procedures:

1. Select an area removed from sampling locations that is both downwind and downgradient. Decontamination must not cause cross-contamination between sampling points.
2. Maintain the same level of personal protection as was used for sampling.
3. To decontaminate a piece of equipment, use an Alconox wash; a tap water wash; a solvent (isopropanol, methanol, or hexane) rinse, if applicable, or dilute (0.1 N) nitric acid rinse, if applicable; a distilled water rinse; and air drying. Use a solvent (isopropanol, methanol, or hexane) rinse for grossly contaminated equipment (for example, equipment that is not readily cleaned by the Alconox wash). The dilute nitric acid rinse may be used if metals are the analyte of concern.
4. Place cleaned equipment in a clean area on plastic sheeting and wrap with aluminum foil.
5. Containerize all water and rinsate.

2.6 GROUNDWATER SAMPLING EQUIPMENT

The following procedures are to be employed for the decontamination of equipment used for groundwater sampling. Decontamination is not necessary when using disposable (single-use) pump tubing or bailers. Bailer and downhole pumps and tubing decontamination procedures are described in the following sections.

2.6.1 Bailers

1. Select an area removed from sampling locations that is both downwind and downgradient. Decontamination must not cause cross-contamination between sampling points.
2. Maintain the same level of personal protection as was used for sampling.
3. Evacuate any purge water in the bailer.
4. Scrub using soap and water and/or steam clean the outside of the bailer.
5. Insert the bailer into a clean container of soapy water. Thoroughly rinse the interior of the bailer with the soapy water. If possible, scrub the inside of the bailer with a scrub brush.
6. Remove the bailer from the container of soapy water.
7. Rinse the interior and exterior of the bailer using tap water.
8. If groundwater contains or is suspected to contain oil, grease, PAH, PCB, or other hard to remove organic materials, rinse equipment with pesticide-grade isopropanol.
9. Rinse the bailer interior and exterior with deionized water to rinse off the tap water and solvent residue, as applicable.
10. Drain residual deionized water to the extent possible.
11. Allow components to air dry.
12. Wrap the bailer in aluminum foil or a clean plastic bag for storage.
13. Containerize the decontamination wash waters for proper disposal.

2.6.2 Downhole Pumps and Tubing

1. Select an area removed from sampling locations that is both downwind and downgradient. Decontamination must not cause cross-contamination between sampling points.

2. Maintain the same level of personal protection as was used for sampling.

3. Evacuate any purge water in the pump and tubing.

4. Scrub using soap and water and/or steam clean the outside of the pump and, if applicable, the pump tubing.

5. Insert the pump and tubing into a clean container of soapy water. Pump/run a sufficient amount of soapy water to flush out any residual well water. After the pump and tubing are flushed, circulate soapy water through the pump and tubing to ensure that the internal components are thoroughly flushed.

6. Remove the pump and tubing from the container.

7. Rinse external pump components using tap water.

8. Insert the pump and tubing into a clean container of tap water. Pump/run a sufficient amount of tap water through the pump to evacuate all of the soapy water (until clear).

9. If groundwater contains or is suspected to contain oil, grease, PAH, PCB, or other hard to remove organic materials, rinse the pump and tubing with pesticide-grade isopropanol.

10. Rinse the pump and tubing with deionized water to flush out the tap water and solvent residue, as applicable.

11. Drain residual deionized water to the extent possible.

12. Allow components to air dry.

13. For submersible bladder pumps, disassemble the pump and wash the internal components with soap and water, rinse with tap water, isopropanol (if necessary), and deionized water, and allow to air dry.

14. Wrap pump and tubing in aluminum foil or a clean plastic bag for storage.

15. Containerize the decontamination wash waters for proper disposal.

3.0 INVESTIGATION-DERIVED WASTE

Investigation-derived waste (IDW) can include disposable single-use PPE and sampling equipment, soil cuttings, and decontamination wash waters and sediments. Requirements for waste storage may differ from one facility to the next. Facility-specific directions for waste storage will be provided in project-specific documents, or separate direction will be provided by the project manager. The following guidelines are provided for general use:

1. Assume that all IDW generated from decontamination activities contains the hazardous chemicals associated with the site unless there are analytical or other data to the contrary. Waste solution volumes could vary from a few gallons to several hundred gallons in cases where large equipment required cleaning.

2. Containerized waste rinse solutions are best stored in 55-gallon drums (or equivalent containers) that can be sealed until ultimate disposal at an approved facility.

3. Label IDW storage containers with the facility name and address, date, contents, company generating the waste, and an emergency contact name and phone number.

4. Temporarily store the IDW in a protected area that provides access to the containers and allows for spill/leak monitoring, sampling of containers, and removal following determination of the disposal method.

SOP APPROVAL FORM

TETRA TECH EM INC.

ENVIRONMENTAL STANDARD OPERATING PROCEDURE

BULK MATERIALS SAMPLING

SOP NO. 007

REVISION NO. 2

Last Reviewed: December 1999

Quality Assurance Approved

May 19, 1993

Date

1.0 BACKGROUND

Bulk materials are typically sampled to characterize a homogeneous collection of a single, identifiable product.

1.1 PURPOSE

This standard operating procedure (SOP) establishes the requirements and procedures for sampling bulk materials.

1.2 SCOPE

This SOP applies to field sampling of bulk materials with a scoop, trier, or grain thief. It provides detailed procedures for gathering such samples with specific sampling equipment.

1.3 DEFINITIONS

HNu® Photoionization Detector (HNu®): A direct-reading air monitoring instrument used to measure the level of organic vapors in air.

Organic Vapor Analyzer (OVA®): An air monitoring instrument used to measure the level of organic vapors in air based on flame ionization.

Grain Thief: A sampling device made of two slotted, concentric, telescoping tubes designed to penetrate solid material.

Trier: A sampling device consisting of a long tube cut in half lengthwise with a sharpened tip that allows the sampler to cut into sticky solids and to loosen cohesive soil.

1.4 REFERENCES

deVera, E.R., and others. 1980. "Samplers and Sampling Procedures for Hazardous Waste Streams." EPA-600/2-80-018. January.

Horwitz, W., and others. 1979. "Animal Feed: Sampling Procedure." *Official Methods of Analysis*. The Association of Official Analytical Chemists. 12th Edition. Washington, DC.

U.S. Environmental Protection Agency. 1984. "Characterization of Hazardous Waste Sites— A Methods Manual: Volume II. Available Sampling Methods." Second Edition. EPA-600/4-84-076. December.

1.5 REQUIREMENTS AND RESOURCES

Sampling of bulk materials can be performed by a variety of equipment. The selection of sampling equipment and procedures should be based on site-specific conditions such as the type and volume of material to be sampled. The selected sampling equipment should be constructed of inert materials that will not react with the material being sampled. The following equipment may be required to sample bulk materials:

- Trier
- Scoop
- Trowel
- Grain thief
- Spoons or spatulas
- OVA® or HNu®
- Decontamination materials
- Sample containers and labels
- Chain-of-custody and shipping materials
- Field logbook
- Stainless-steel or Teflon® tray

Additional resources for sampling bulk materials are discussed in *The Sampling of Bulk Materials* by R. Smith and G. V. James of the Royal Society of Chemistry, London (1981). Although this book does not

deal specifically with hazardous waste sampling, the concepts discussed are applicable, especially those regarding establishment of a sampling scheme.

2.0 PROCEDURES

Bulk materials are usually contained in bags, drums, or hoppers, although large amounts of material may be piled on the ground, either deliberately or as the result of a spill.

Material surfaces exposed to the atmosphere may undergo chemical alteration or degradation and should be removed before initiating sample collection. Because the process conditions that produced the bulk material may have varied over time, a series of samples should be collected and composited into one sample to represent the material. Samples collected for volatile organic compound analysis should not be composited.

The following sections provide detailed procedures for sampling bulk materials with a trier, scoop, or trowel, and with a grain thief.

2.1 SAMPLING BULK MATERIALS WITH A TRIER, SCOOP, OR TROWEL

A typical trier (Figure 1) is a long tube with a slot that extends almost its entire length. The tip and edges of the tube slot are sharpened to allow the trier to cut a core after being inserted into the material. A trier is most useful when sampling moist or sticky solids and powdered or granular material with a particle diameter less than half the diameter of the trier. Sampling triers are usually made of stainless steel and have wooden handles. Triers are 24 to 40 inches long and 0.5 to 1.0 inch in diameter. They can be purchased from laboratory supply companies.

A scoop or trowel may be used for sampling bulk materials as well as dry, granular, or powdered material in bins or other shallow containers. A scoop is preferred over a trowel because the scoop is usually made of materials less subject to corrosion and chemical reactions.

A trowel is shaped like a small shovel; the blade is usually 3 to 5 inches long and has a sharp tip. A scoop is similar to a trowel, but the blade is usually more curved and has a closed upper end to contain the sampled material. Scoops are available in different sizes and shapes; stainless-steel and polypropylene scoops with blades 3 to 6 inches long are recommended. Trowels can be purchased from hardware stores; scoops are generally available from laboratory supply companies.

The following procedure can be used to sample bulk materials with a trier, scoop, or trowel:

1. Place all sampling equipment on plastic sheeting next to the sampling location. Sample containers should be selected in accordance with the requirements in SOP No. 017, Sample Collection Container Requirements.

2. Wear appropriate protective clothing and gear. Use an HNu® or OVA® to monitor for levels of volatile organic vapors that may be present in accordance with SOP No. 003, Organic Vapor Air Monitoring.

3. Affix a completed sample container label to the appropriate sample container.

4. Insert a clean trier, scoop, or trowel (implement) into the material at a 0 to 45 degree angle from horizontal. This orientation minimizes sample spillage.

5. If the material is cohesive, rotate the implement once or twice to cut a core of material.

6. Slowly withdraw the implement, making sure the slot or blade is facing upward.

7. If composite sampling is required, repeat steps 4 through 6 at different points two or more times. Combine the samples in a stainless-steel bowl or similar container.

8. Transfer the sample into the labeled container using a stainless-steel or plastic spoon, spatula, or similar tool.

9. Ensure that a Teflon® liner is present in the cap of the sample container cap, if required. Secure the cap tightly on the sample container.

10. Complete all chain-of-custody documents, field logbook entries, and packaging requirements.

11. Decontaminate all nondisposable sampling implements after each use and between sampling locations using the procedures in SOP No. 002, General Equipment Decontamination.

2.2 SAMPLING BULK MATERIALS WITH A GRAIN THIEF

A grain thief is used for sampling powdered or granular materials in bags, fiber drums, sacks, or similar containers. This sampler is useful when the material contains particles no greater than 0.25 inch in diameter.

A grain thief (Figure 2) consists of two slotted, concentric, telescoping tubes, usually made of brass or stainless steel. The outer tube has a conical, pointed tip on one end that permits the sampler to penetrate the material being sampled. The sampler is about 24 to 40 inches long and 0.5 to 1 inch in diameter. Grain thieves are commercially available from laboratory supply companies.

The following procedure can be used to sample bulk materials with a thief:

1. Place all sampling equipment on plastic sheeting next to the sampling location. Sample containers should be selected in accordance with the requirements in SOP No. 017, Sample Collection Container Requirements.

2. Wear appropriate protective clothing and gear. Use an HNu® or OVA® to monitor for levels of volatile organic vapors that may be present in accordance with SOP No. 003, Organic Vapor Air Monitoring.

3. Affix a completed sample container label to an appropriate sample container.

4. Insert a clean grain thief in the closed position into the material. Insert it from a point near the top edge or corner of the material, through the center, and to a point opposite the point of entry.

5. Rotate the inner tube of the grain thief into the open position. Wiggle the thief a few times to allow the material being sampled to enter the open slots. Close the grain thief and withdraw it from the material.

6. Place the grain thief in a horizontal position with the slots facing upward. Rotate the outer tube and slide it away from the inner tube.

7. If composite sampling is required, repeat steps 4 through 6 at different points two or more times. Combine the samples in a stainless-steel bowl or similar container.

8. Transfer the sample into the labeled container using a stainless-steel or plastic spoon, spatula, or similar tool.

9. Ensure that a Teflon® liner is present in the cap of the sample container, if required. Secure the cap tightly on the sample container.

10. Complete all chain-of-custody documents, field logbook entries, and packaging requirements.

11. Decontaminate all nondisposable sampling equipment after each use and between sampling locations using the procedures in SOP No. 002, General Equipment Decontamination.

FIGURE 1

TRIER

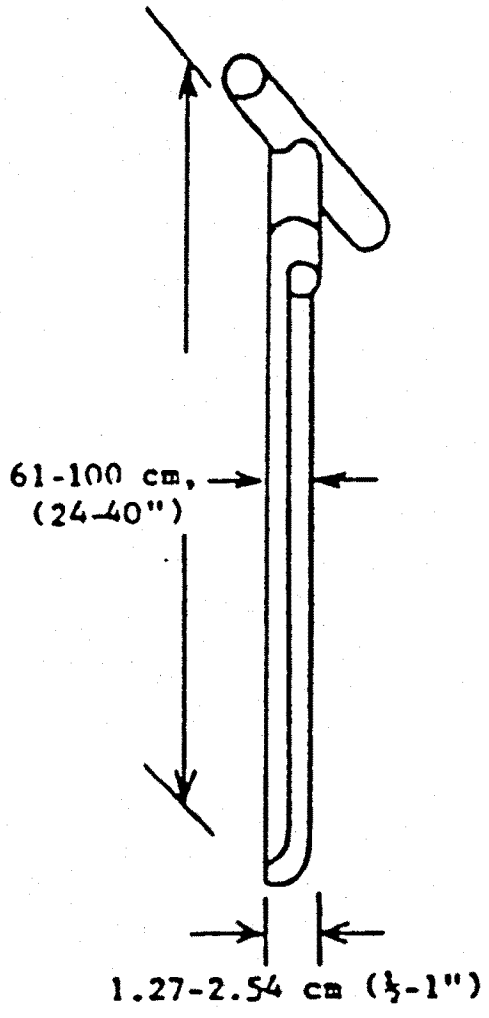
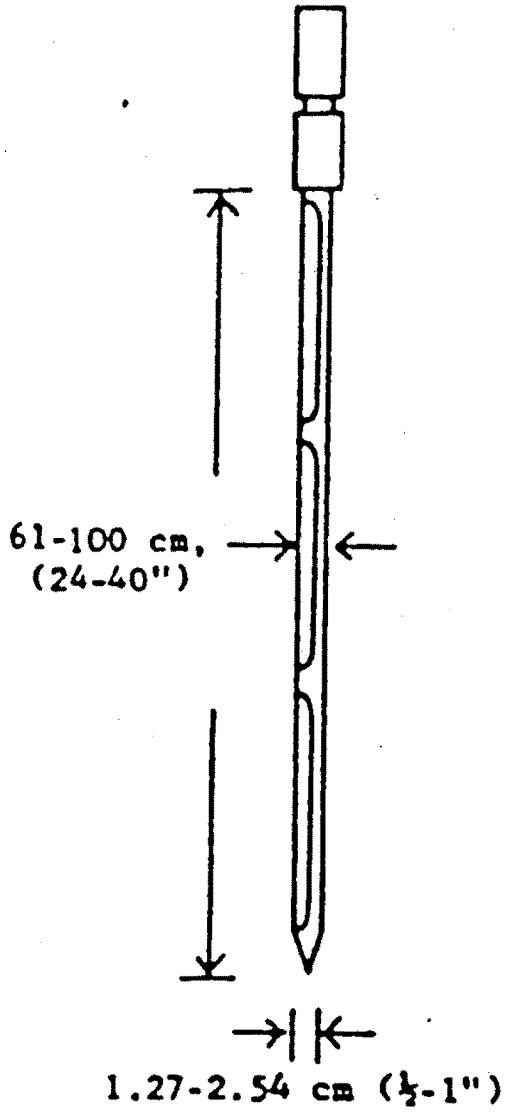


FIGURE 2

GRAIN THIEF



SOP APPROVAL FORM

TETRA TECH EM INC.

ENVIRONMENTAL STANDARD OPERATING PROCEDURE

PACKAGING AND SHIPPING SAMPLES

SOP NO. 019

REVISION NO. 6

December 2008

Quality Assurance Approved	December 18, 2008
	Date

1.0 BACKGROUND

In any sampling program, the integrity of a sample must be ensured from its point of collection to its final disposition. Procedures for classifying, packaging, and shipping samples are described below. Steps in the procedures should be followed to ensure sample integrity and to protect the welfare of persons involved in shipping and receiving samples. When hazardous substances and dangerous goods are sent by common carrier, their packaging, labeling, and shipping are regulated by four primary agencies that have regulatory or advisory guidelines: (1) the U.S. Department of Transportation (DOT) Hazardous Materials Regulations (HMR, *Code of Federal Regulations*, Title 49 [49 CFR] Parts 106 through 180); (2) the International Air Transportation Association (IATA) Dangerous Goods Regulations (DGR); (3) International Civil Aviation Organization (ICAO), which provides technical instructions for safe transportation of hazardous materials (dangerous goods) by air; and (4) United Nations (UN) "Recommendations of the Committee of Experts on Transport of Dangerous Goods."

1.1 PURPOSE

This standard operating procedure (SOP) establishes the requirements and procedures for packaging and shipping samples. It has been prepared in accordance with the U.S. Environmental Protection Agency (EPA) "Sampler's Guide to the Contract Laboratory Program (CLP)," the DGR, the HMR, ICAO, and UN. Sample packaging and shipping procedures described in this SOP should be followed for all sample packaging and shipping. Deviations from the procedures in this SOP must be documented in a field logbook. This SOP assumes that samples are already collected in the appropriate sample jars and that the sample jars are labeled and tagged appropriately.

1.2 SCOPE

This SOP applies to sample classification, packaging, and shipping.

1.3 DEFINITIONS

Custody seal: A custody seal is a tape-like seal. Placement of the custody seal is part of the chain-of-custody process and is used to prevent tampering with samples after they have been packaged for shipping.

Dangerous goods: Dangerous goods are articles or substances that can pose a significant risk to health, safety, or property when transported by air; they are classified as defined in Section 3 of the DGR (IATA 2008).

Environmental samples: Environmental samples include drinking water, most groundwater and ambient surface water, soil, sediment, treated municipal and industrial wastewater effluent, and biological specimens. Environmental samples typically contain low concentrations of contaminants and when handled require only limited precautionary procedures.

Hazardous Materials Regulations: The HMR are DOT regulations for the shipment of hazardous materials by air, water, and land; they are located in 49 CFR 106 through 180.

Hazardous samples: Hazardous samples include dangerous goods and hazardous substances. Hazardous samples shipped by air should be packaged and labeled in accordance with procedures specified by the DGR; ground shipments should be packaged and labeled in accordance with the HMR.

Hazardous substance: A hazardous substance is any material, including its mixtures and solutions, that is listed in Appendix A of 49 CFR 172.101 and its quantity, in one package, equals or exceeds the reportable quantity (RQ) listed in the appendix.

IATA Dangerous Goods Regulations: The DGR are regulations that govern the international transport of dangerous goods by air. The DGR are based on the International Civil Aviation Organization (ICAO) Technical Instructions. The DGR contain all of the requirements of the ICAO Technical Instructions and are more restrictive in some instances.

Nonhazardous samples: Nonhazardous samples are those samples that do not meet the definition of a hazardous sample and **do not** need to be packaged and shipped in accordance with the DGR or HMR.

Overpack: An enclosure used by a single shipper to contain one or more packages and to form one handling unit (IATA 2008). For example, a cardboard box may be used to contain three fiberboard boxes to make handling easier and to save on shipping costs.

1.4 REFERENCES

U.S. Department of Transportation (DOT). 2007. Code of Federal Regulations, Title 49, Parts 171 through 180, especially Parts 171 (general), 172 (table, emergency response, and so on), and 173 (for shippers). Available from http://www.access.gpo.gov/nara/cfr/cfr-table-search.html#page1. Updated annually, late in the year or early in the following year.

DOT. 2008. "Hazardous Materials Table". (49 CFR 172.101 Table) Available on-line from http://phmsa.dot.gov/hazmat/library. Updated irregularly.

DOT. 2008. "Emergency Response Guidebook". Available on-line at http://phmsa.dot.gov/hazmat/library/erg. Updated annually.

Federal Express. 2008. "Dangerous Goods Shipping". Available on-line from http://www.fedex.com/us/services/options/dangerousgoods/index.html. Note especially "Declaration Forms", which can be filled out on-line or downloaded for future use, and "Resources", which includes the "Dangerous Goods Job Aid" on how to fill out the form, mark the package, and so on, the "Shipping Checklists" and the 1-800 numbers for assistance.

International Air Transport Association (IATA). 2008. "Dangerous Goods Regulations. 2009". For sale at http://www.iata.org/ps/publications/dgr.htm. Updated annually, with new edition available late in year.

U.S. Environmental Protection Agency. 2007. "Contract Laboratory Program Guidance for Field Samplers". EPA 540-R-07-06. Available on-line at http://www.epa.gov/superfund/programs/clp/download/sampler/clp_sampler_guidance.pdf. July.

The following additional in-house resources are also available:

Email: Contact either the TtEMI Health & Safety Director and the Regional Safety Officers at EMI.HASPApprovers or your Office Health and Safety Representative (all are included at EMI.HealthSafety).

On-line: TtEMI Intranet Page "Dangerous Goods Shipping" at http://home.ttemi.com/C14/Dangerous%20Goods%20Shipping/default.aspx. Includes the "Dangerous Goods Shipping Manual", various "Emergency Response Guide" excerpts, and other information, updated regularly.

1.5 REQUIREMENTS AND RESOURCES

The procedures for packaging and shipping **nonhazardous** samples require the following:

- Coolers
- Ice
- Vermiculite, bubble wrap, or similar cushioning material
- Chain-of-custody forms and seals
- Airbills
- Resealable plastic bags for sample jars and ice
- Tape (strapping and clear)

The procedures for packaging and shipping **hazardous** samples require the following:

- Ice
- Vermiculite or other non-combustible, absorbent packing material
- Chain-of-custody forms and seals
- Appropriate dangerous goods airbills and emergency response information to attach to the airbill
- Resealable plastic bags for sample jars and ice
- Tape (strapping and clear)
- Appropriate shipping containers as specified in the DGR
- Labels that apply to the shipment such as hazard labels, address labels, "Cargo Aircraft Only" labels, and package orientation labels (up arrows)

2.0 PROCEDURES

The following procedures apply to packaging and shipping nonhazardous and hazardous samples.

2.1 SAMPLE CLASSIFICATION

Prior to sample shipment, it must be determined whether the sample is subject to the DGR. Samples subject to these regulations shall be referred to as hazardous samples. If the hazardous sample is to be shipped by air, then the DGR should be followed. Any airline, including FedEx, belonging to IATA must follow the DGR. As a result, FedEx **may not** accept a shipment that is packaged and labeled in accordance with the HMR (although in most cases, the packaging and labeling would be the same for either set of regulations). The HMR states that a hazardous material may be transported by aircraft in accordance with the ICAO Technical Instruction (49 CFR 171.11) upon which the DGR is based. Therefore, the use of the DGR for samples to be shipped by air complies with the HMR, but not vice versa.

Most environmental samples are not hazardous samples and do not need to be packaged in accordance with any regulations. Hazardous samples are those samples that can be classified as specified in Section 3 of the DGR, can be found in the List of Dangerous Goods in the DGR in bold type, are considered a hazardous substance (see definition), or are mentioned in "Section 2 - Limitations" of the DGR for countries of transport or airlines (such as FedEx). The hazard classifications specified in the DGR (and the HMR) are as follows:

Class 1 - Explosives

- Division 1.1 - Articles and substances having a mass explosion hazard
- Division 1.2 - Articles and substances having a projection hazard but not a mass explosion hazard
- Division 1.3 - Articles and substances having a fire hazard, a minor blast hazard and/or a minor projection hazard but not a mass explosion hazard
- Division 1.4 - Articles and substances presenting no significant hazard
- Division 1.5 - Very sensitive substances mass explosion hazard
- Division 1.6 - Extremely insensitive articles which do not have a mass explosion hazard

Class 2 - Gases

Division 2.1 - Flammable gas
Division 2.2 - Non-flammable, non-toxic gas
Division 2.3 - Toxic gas

Class 3 - Flammable Liquids

Class 4 - Flammable Solids; Substances Liable to Spontaneous Combustion; Substances, which, in Contact with Water, Emit Flammable Gases

Division 4.1 - Flammable solids
Division 4.2 - Substances liable to spontaneous combustion
Division 4.3 - Substances, which, in contact with water, emit flammable gases

Class 5 - Oxidizing Substances and Organic Peroxides

Division 5.1 - Oxidizers
Division 5.2 - Organic peroxides

Class 6 - Toxic and Infectious Substances

Division 6.1 - Toxic substances
Division 6.2 - Infectious substances

Class 7 - Radioactive Materials

Class 8 - Corrosives

Class 9 - Miscellaneous Dangerous Goods

The criteria for each of the first eight classes are very specific and are outlined in Section 3 of the DGR and 49 CFR 173 of the HMR. Some classes and divisions are further divided into packing groups based on their level of danger. Packing group I indicates a great danger, packing group II indicates a medium danger, and packing group III indicates a minor danger.

Class 1, explosives, includes any chemical compound, mixture, or device that by itself is capable of chemical chain reaction sufficient to produce a substantial, instantaneous release of gas, heat, and/or pressure. Tetra Tech does not ship substances that fall under this class.

Class 2, gases, includes any compressed gas being shipped and any noncompressed gas that is either flammable or toxic. A compressed gas is defined as having a pressure over 40 pounds per square inch (psi) absolute (25 psi gauge). Most air samples and empty cylinders that did not contain a flammable or toxic gas are exempt from the regulations. An empty hydrogen cylinder, as in a flame ionization detector (FID), is considered a dangerous good unless it is properly purged with nitrogen in accordance with the HMR. A landfill gas sample is usually considered a flammable gas because it may contain a high percentage of methane.

Class 3, flammable liquids, are based on the boiling point and flash point of a substance. DOT defines flammable liquids as substances with a flash point less than 140 °F. Most class 3 samples include solvents, oil, gas, or paint-related material collected from drums, tanks, or pits.

Class 4 are flammable solids; substances liable to spontaneous combustion; and substances which, in contact with water, emit flammable gasses. Tetra Tech does not ship substances that fall under this class.

Class 5, oxidizers and organic peroxides, include substances that readily yields oxygen, which may result in the ignition of combustible materials. Organic peroxide is combustible and reacts as an oxidizer in contact with other combustible materials. By itself, an organic peroxide can be flammable or explosive. Tetra Tech does not ship substances that fall under this class.

Division 6, toxic and infectious substances, is based on oral toxicity (LD_{50} [lethal dose that kills 50 percent of the test animals]), dermal toxicity (LD_{50} values), and inhalation toxicity (LC_{50} [lethal concentration that kills 50 percent of the test animals] values). Division 6.1 substances include pesticides and cyanide. Tetra Tech does not ship substances that fall under this class.

Class 7, radioactive material, is defined as any article or substance with a specific activity greater than 70 kiloBecquerels (kBq/kg) (0.002 [microCuries per gram [: Ci/g]). If the specific activity exceeds this level, the sample should be shipped in accordance with Section 10 of the DGR.

Class 8, corrosives, are based on the rate at which a substance destroys skin tissue or corrodes steel; they are not based on pH. Class 8 materials include the concentrated acids used to preserve water samples. Preserved water samples are not considered Class 8 substances and should be packaged as nonhazardous samples.

Class 9, miscellaneous dangerous goods, are substances that present a danger but are not covered by any other hazard class. Examples of Class 9 substances include asbestos, polychlorinated biphenyls (PCB), and dry ice.

Unlike the DGR, the HMR includes combustible liquids in hazard class 3. The definition of a combustible liquid is specified in 49 CFR 173.120 of the HMR. The HMR has an additional class, ORM-D, that is not specified in the DGR. "ORM-D material" refers to a material such as a consumer commodity that, although otherwise subject to the HMR, presents a limited hazard during transport due to its form, quantity, and packaging. It must be a material for which exceptions are provided in the table of 49 CFR 172.101. The DGR lists consumer commodities as a Class 9 material.

In most instances, the hazard of a material sampled is unknown because no laboratory testing has been conducted. A determination as to the suspected hazard of the sample must be made using knowledge of the site, field observations, field tests, and other available information.

According to 40 CFR 261.4(d) and (e), samples transported to a laboratory for testing or treatability studies, including samples of hazardous wastes, are **not** hazardous wastes. FedEx will not accept a shipment of hazardous waste.

2.2 PACKAGING NONHAZARDOUS SAMPLES

Nonhazardous samples, after being appropriately containerized, labeled, and tagged, should be packaged in the following manner. Note that these are general instructions; samplers should be aware of any client-specific requirements concerning the placement of custody seals or other packaging provisions.

1. Place the sample in a resealable plastic bag.
2. Place the bagged sample in a cooler and pack it to prevent breakage.
3. Prevent breakage of bottles during shipment by either wrapping the sample container in bubble wrap, or lining the cooler (bottom and sides) with a noncombustible material such as vermiculite. Vermiculite is especially recommended because it will absorb any free liquids inside the cooler. It is recommended that the cooler be lined with a large plastic garbage bag before samples, ice, and absorbent packing material are placed in the cooler.

4. Add a sufficient quantity of ice to the cooler to cool samples to 4 °C. Ice should be double bagged in resealable plastic bags to prevent the melted ice from leaking out. As an option, a temperature blank (a sample bottle filled with distilled water) can be included with the cooler.

5. Seal the completed chain-of-custody forms in a plastic bag and tape the plastic bag to the inside of the cooler lid.

6. Tape any instructions for returning the cooler to the inside of the lid.

7. Close the lid of the cooler and tape it shut by wrapping strapping tape around both ends and hinges of the cooler at least once. Tape shut any drain plugs on the cooler.

8. Place two signed custody seals on the cooler, ensuring that each one covers the cooler lid and side of the cooler. Place clear plastic tape over the custody seals.

9. Place address labels on the outside top of the cooler.

10. Ship samples overnight by a commercial carrier such as FedEx.

2.3 PACKAGING HAZARDOUS SAMPLES

The procedures for packaging hazardous samples are summarized below. Note that according to the DGR, all spellings must be exactly as they appear in the List of Dangerous Goods, and only approved abbreviations are acceptable. The corresponding HMR regulations are provided in parentheses following any DGR referrals. The HMR must be followed only if shipping hazardous samples by ground transport.

1. Determine the proper shipping name for the material to be shipped. All proper shipping names are listed in column B of the List of Dangerous Goods table in Section 4 of the DGR (or column 2 of the Hazardous Materials Table in 49 CFR 172.101). In most instances, a generic name based on the hazard class of the material is appropriate. For example, a sample of an oily liquid collected from a drum with a high photoionization detector (PID) reading should be packaged as a flammable liquid. The proper shipping name chosen for this sample would be "flammable liquid, n.o.s." The abbreviation "n.o.s." stands for "not otherwise specified" and is used for generic shipping names. Typically, a specific name, such as acetone, should be inserted in parentheses after most n.o.s. descriptions. However, a technical name is not required when shipping a sample for testing purposes and the components are not known. If shipping a hazardous substance (see definition), then the letters "RQ" must appear in front of the proper shipping name.

2. Determine the United Nations (UN) identification number, class or division, subsidiary risk if any, required hazard labels, packing group, and either passenger aircraft or cargo aircraft packing instructions based on the quantity of material being shipped in one

package. This information is provided in the List of Dangerous Goods (or Hazardous Materials Table in 49 CFR 172.101) under the appropriate proper shipping name. A "Y" in front of a packing instruction indicates a limited quantity packing instruction. If shipping dry ice or a limited quantity of a material, then UN specification shipping containers do not need to be used.

3. Determine the proper packaging required for shipping the samples. Except for limited quantity shipments and dry ice, these are UN specification packages that have been tested to meet the packing group of the material being shipped. Specific testing requirements of the packages is listed in Section 6 of the DGR (or 49 CFR 178 of the HMR). All UN packages are stamped with the appropriate UN specification marking. Prior planning is required to have the appropriate packages on hand during a sampling event where hazardous samples are anticipated. Most samples can be shipped in either a 4G fiberboard box, a 1A2 steel drum, or a 1H2 plastic drum. Drums can be purchased in 5- and 20-gallon sizes and are ideal for shipping multiple hazardous samples. When FedEx is used to ship samples containing PCBs, the samples must be shipped in an inner metal packaging (paint can) inside a 1A2 outer steel drum. This method of packaging PCB samples is in accordance with FedEx variation FX-06, listed in Section 2 of the DGR.

4. Place each sample jar in a separate resealable plastic bag. Some UN specification packagings contain the sample jar and plastic bag to be used when shipping the sample.

5. Place each sealed bag inside the approved UN specification container (or other appropriate container if a limited quantity or dry ice) and pack with enough noncombustible, absorbent, cushioning material (such as vermiculite) to prevent breakage and to absorb liquid.

6. Place chain-of-custody forms in a resealable plastic bag and either attach it to the inside lid of the container or place it on top inside the container. Place instructions for returning the container to the shipper on the inside lid of the container as appropriate. Close and seal the shipping container in the manner appropriate for the type of container being used.

7. Label and mark each package appropriately. All irrelevant markings and labels need to be removed or obliterated. All outer packagings must be marked with proper shipping name; identification number; and name, address, and phone numbers of the shipper and the recipient. For carbon dioxide, solid (dry ice), the net weight of the dry ice within the package needs to be marked on the outer package. For limited quantity shipments, the words "limited quantity" or "LTD. QTY." must be marked on the outer package. Affix the appropriate hazard label to the outer package. If the material being shipped contains a subsidiary hazard, then a subsidiary hazard label must also be affixed to the outer package. The subsidiary hazard label is identical to the primary hazard label except that the class or division number is not present. It is acceptable to obliterate the class or division marking on a primary hazard label and use it as the subsidiary hazard label. If using cargo aircraft only packing instructions, then the "Cargo Aircraft Only" label must be used. Package orientation labels (up arrows) must be placed on opposite sides of the outer package. Figure 1 depicts a properly marked and labeled package.

8. If using an overpack (see definition), mark and label the overpack and each outer packaging within the overpack as described in step 7. In addition, the statement "INNER PACKAGES COMPLY WITH PRESCRIBED SPECIFICATIONS" must be marked on the overpack.

9. Attach custody seals, and fill out the appropriate shipping papers as described in Section 2.4.

2.4 SHIPPING PAPERS FOR HAZARDOUS SAMPLES

A "Shippers Declaration for Dangerous Goods" and "Air Waybill" must be completed for each shipment of hazardous samples. Four copies of the Shipper's Declaration are required and it must be typed. FedEx supplies a Dangerous Goods Airbill to its customers; the airbill combines both the declaration and the waybill. An example of a completed Dangerous Goods Airbill is depicted in Figure 2. A shipper's declaration must contain the following:

- Name and address of shipper and recipient
- Air waybill number (not applicable to the HMR)
- Page ___ of ___
- Shipper's reference number (project number)
- Deletion of either "Passenger and Cargo Aircraft" or "Cargo Aircraft Only," whichever does not apply
- Airport or city of departure
- Airport or city of destination
- Deletion of either "Non-Radioactive" or "Radioactive," which ever does not apply
- The nature and quantity of dangerous goods. This includes the following information in the following order (obtained from the List of Dangerous Goods in the DGR): proper shipping name, class or division number, UN identification number, packing group number, subsidiary risk, quantity in liters or kilograms (kg), type of packaging used, packing instructions, authorizations, and additional handling information. Authorizations include the words "limited quantity" or "LTD. QTY." if shipping a limited quantity, any special provision numbers listed in the List of Dangerous Goods in the DGR, and the variation "USG-14" when a technical name is required after the proper shipping name but not entered because it is unknown.

- Signature for the certification statement
- Name and title of signatory
- Place and date of signing certification
- A 24-hour emergency response telephone number for use in the event of an incident involving the dangerous good
- Emergency response information attached to the shipper's declaration. This information can be in the form of a material safety data sheet or the applicable North American Emergency Response Guidebook (NAERG; DOT 1996) pages. Figure 3 depicts the appropriate NAERG emergency response information for "Flammable liquids, n.o.s." as an example.

Note that dry ice does not require an attached shipper's declaration. However, the air waybill must include the following on it: "Dry ice, 9, UN1845, ____ x ____ kg." The blanks must include the number of packages and the quantity in kg in each package. If using FedEx to ship dry ice, the air waybill includes a box specifically for dry ice. Simply check the appropriate box and enter in the number of packages and quantity in each package.

The HMR requirements for shipping papers are located in 49 CFR 172 Subpart C.

3.0 POTENTIAL PROBLEMS

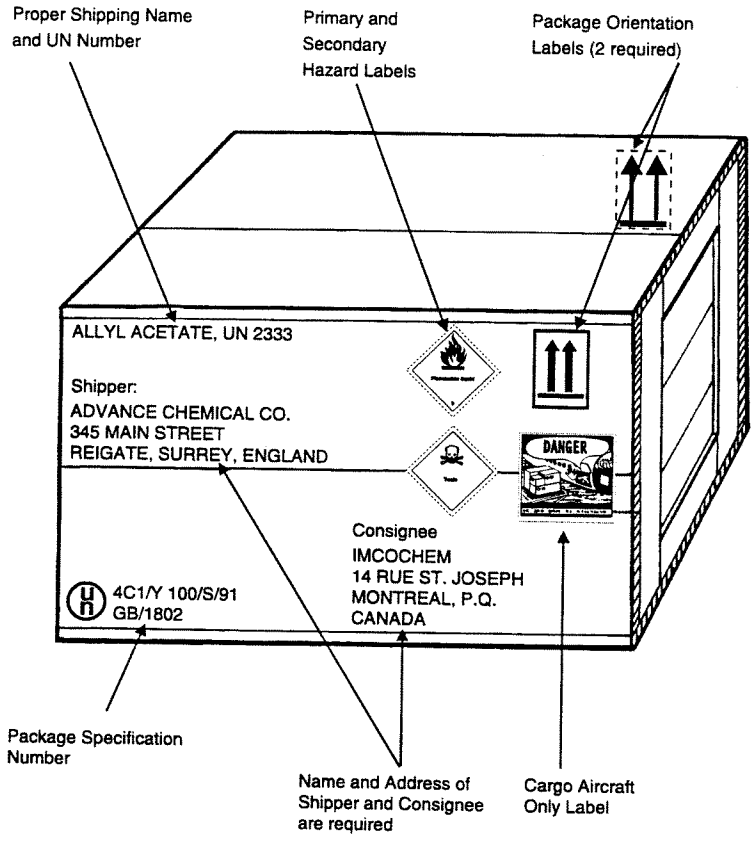
The following potential problems may occur during sample shipment:

- Leaking package. If a package leaks, the carrier may open the package, return the package, and if a dangerous good, inform the Federal Aviation Administration (FAA), which can result in fines.
- Improper labeling and marking of package. If mistakes are made in labeling and marking the package, the carrier will most likely notice the mistakes and return the package to the shipper, thus delaying sample shipment.
- Improper, misspelled, or missing information on the shipper's declaration. The carrier will most likely notice this as well and return the package to the shipper.

Contact FedEx with questions about dangerous goods shipments by calling 1-800-463-3339 and asking for a dangerous goods expert.

Also contact Tetra Tech health and safety representatives using the website identified on Page 3 of this SOP.

FIGURE 1
EXAMPLE OF A CORRECTLY MARKED AND LABELED DANGEROUS GOODS PACKAGE



Source: International Air Transport Association (IATA). 1997.

FIGURE 2

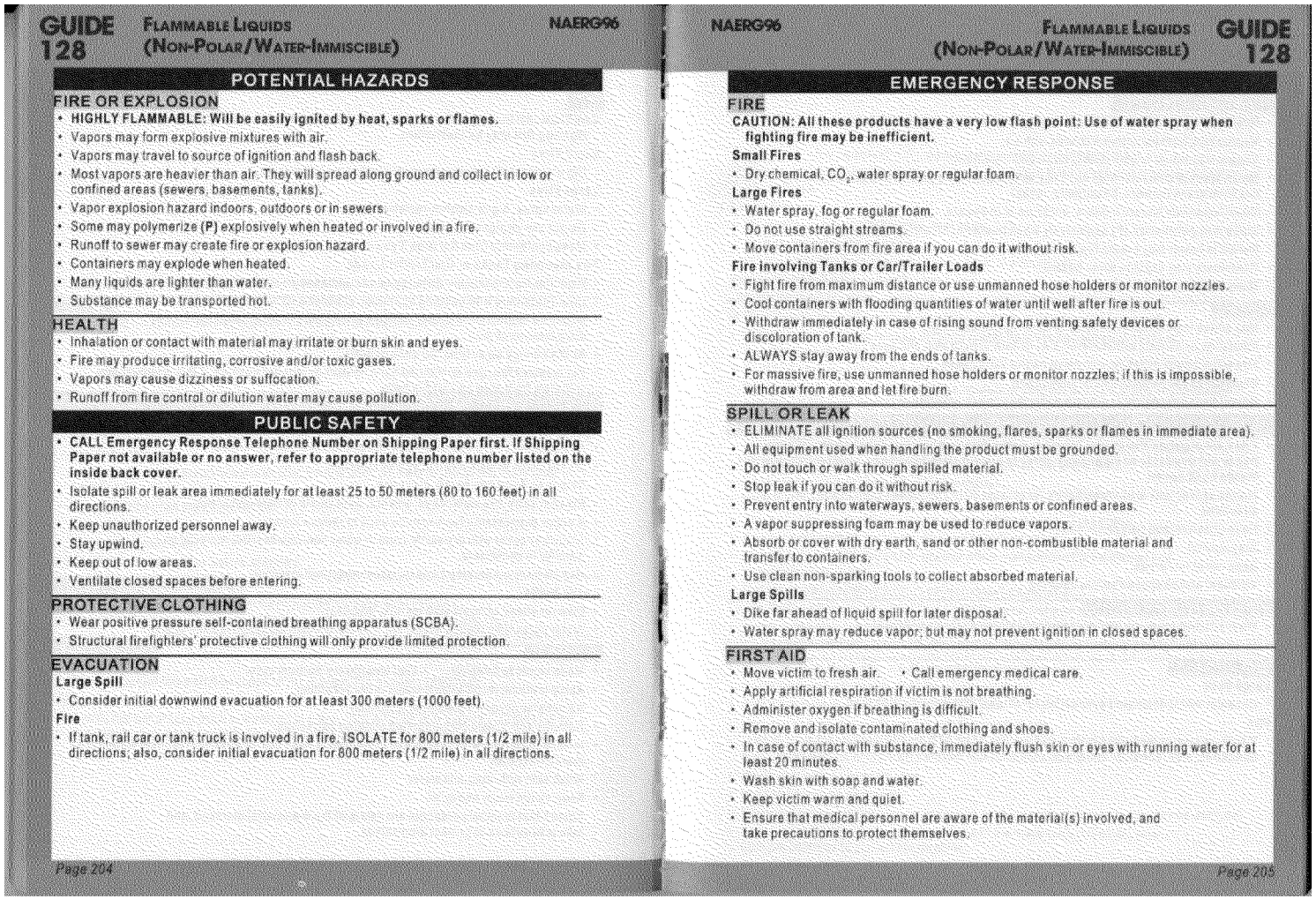
EXAMPLE OF A DANGEROUS GOODS AIRBILL

Filling Out the FedEx Dangerous Goods Airbill

- The Dangerous Goods Airbill has two sections
  - The top section of the page is the airbill portion.
  - The bottom section is the Shipper's Declaration for Dangerous Goods.
- The sender *must complete* the following fields on the pre-printed airbill:
  - Section 1: Date
  - Section 1: Sender's Name
  - Section 7: Total Packages
  - Section 7: Total Weight
- Declaration for Dangerous Goods:
  - Under the section labeled "Proper Shipping Name" fill in the infectious substance (i.e., HIV, HCV, etc.) in the parentheses.
  - Under the "Quantity and Type of Packing" section, fill in the amount of specimen in the box (in mls).
  - List an emergency telephone number in the space provided at the bottom of the airbill.
  - Sign and date the airbill in the bottom right corner.

IMPORTANT: You must follow explicitly all packaging and labeling instructions for shipping infectious substances. Correct spelling and legibility are important. Otherwise, your package will be delayed or may be rejected by FedEx.

FIGURE 3
NAERG EMERGENCY RESPONSE INFORMATION
FOR FLAMMABLE LIQUIDS, N.O.S.



GUIDE 128 FLAMMABLE LIQUIDS (NON-POLAR/WATER-IMMISCIBLE) NAERG96

POTENTIAL HAZARDS

FIRE OR EXPLOSION

- **HIGHLY FLAMMABLE: Will be easily ignited by heat, sparks or flames.**
- Vapors may form explosive mixtures with air.
- Vapors may travel to source of ignition and flash back.
- Most vapors are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks).
- Vapor explosion hazard indoors, outdoors or in sewers.
- Some may polymerize (P) explosively when heated or involved in a fire.
- Runoff to sewer may create fire or explosion hazard.
- Containers may explode when heated.
- Many liquids are lighter than water.
- Substance may be transported hot.

HEALTH

- Inhalation or contact with material may irritate or burn skin and eyes.
- Fire may produce irritating, corrosive and/or toxic gases.
- Vapors may cause dizziness or suffocation.
- Runoff from fire control or dilution water may cause pollution.

PUBLIC SAFETY

- **CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, refer to appropriate telephone number listed on the inside back cover.**
- Isolate spill or leak area immediately for at least 25 to 50 meters (80 to 160 feet) in all directions.
- Keep unauthorized personnel away.
- Stay upwind.
- Keep out of low areas.
- Ventilate closed spaces before entering.

PROTECTIVE CLOTHING

- Wear positive pressure self-contained breathing apparatus (SCBA).
- Structural firefighters' protective clothing will only provide limited protection.

EVACUATION

Large Spill

- Consider initial downwind evacuation for at least 300 meters (1000 feet).

Fire

- If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions.

Page 204

NAERG96 FLAMMABLE LIQUIDS (NON-POLAR/WATER-IMMISCIBLE) GUIDE 128

EMERGENCY RESPONSE

FIRE

CAUTION: All these products have a very low flash point: Use of water spray when fighting fire may be inefficient.

Small Fires

- Dry chemical, CO_2, water spray or regular foam.

Large Fires

- Water spray, fog or regular foam.
- Do not use straight streams.
- Move containers from fire area if you can do it without risk.

Fire involving Tanks or Car/Trailer Loads

- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Cool containers with flooding quantities of water until well after fire is out.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- ALWAYS stay away from the ends of tanks.
- For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.

SPILL OR LEAK

- ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area).
- All equipment used when handling the product must be grounded.
- Do not touch or walk through spilled material.
- Stop leak if you can do it without risk.
- Prevent entry into waterways, sewers, basements or confined areas.
- A vapor suppressing foam may be used to reduce vapors.
- Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers.
- Use clean non-sparking tools to collect absorbed material.

Large Spills

- Dike far ahead of liquid spill for later disposal.
- Water spray may reduce vapor; but may not prevent ignition in closed spaces.

FIRST AID

- Move victim to fresh air.
- Call emergency medical care.
- Apply artificial respiration if victim is not breathing.
- Administer oxygen if breathing is difficult.
- Remove and isolate contaminated clothing and shoes.
- In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
- Wash skin with soap and water.
- Keep victim warm and quiet.
- Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

Page 205

Source: DOT and others. 1996.